



US010553941B2

(12) **United States Patent**  
**Langer**

(10) **Patent No.:** **US 10,553,941 B2**

(45) **Date of Patent:** **Feb. 4, 2020**

(54) **SIMPLIFIED ANTENNA PEAKING APPARATUS**

(71) Applicant: **Dish Network L.L.C.**, Englewood, CO (US)

(72) Inventor: **Paul Langer**, Englewood, CO (US)

(73) Assignee: **DISH NETWORK L.L.C.**, Englewood, CO (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/522,528**

(22) Filed: **Jul. 25, 2019**

(65) **Prior Publication Data**

US 2019/0348758 A1 Nov. 14, 2019

**Related U.S. Application Data**

(63) Continuation of application No. 15/855,821, filed on Dec. 27, 2017, now Pat. No. 10,396,454.

(51) **Int. Cl.**

**H01Q 3/08** (2006.01)  
**H01Q 1/12** (2006.01)  
**H01Q 15/14** (2006.01)

(52) **U.S. Cl.**

CPC ..... **H01Q 3/08** (2013.01); **H01Q 1/125** (2013.01); **H01Q 15/14** (2013.01)

(58) **Field of Classification Search**

CPC ..... H01Q 3/08; H01Q 1/12; H01Q 15/14  
USPC ..... 343/882

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2002/0084948 A1\* 7/2002 Watson ..... H01Q 1/125  
343/882

2016/0336640 A1\* 11/2016 Bailey ..... H01Q 1/125

\* cited by examiner

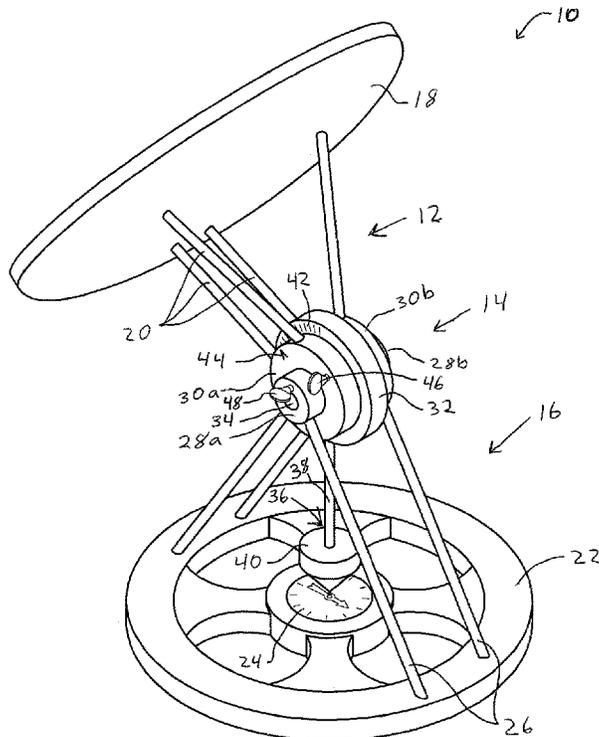
*Primary Examiner* — Andrea Lindgren Baltzell

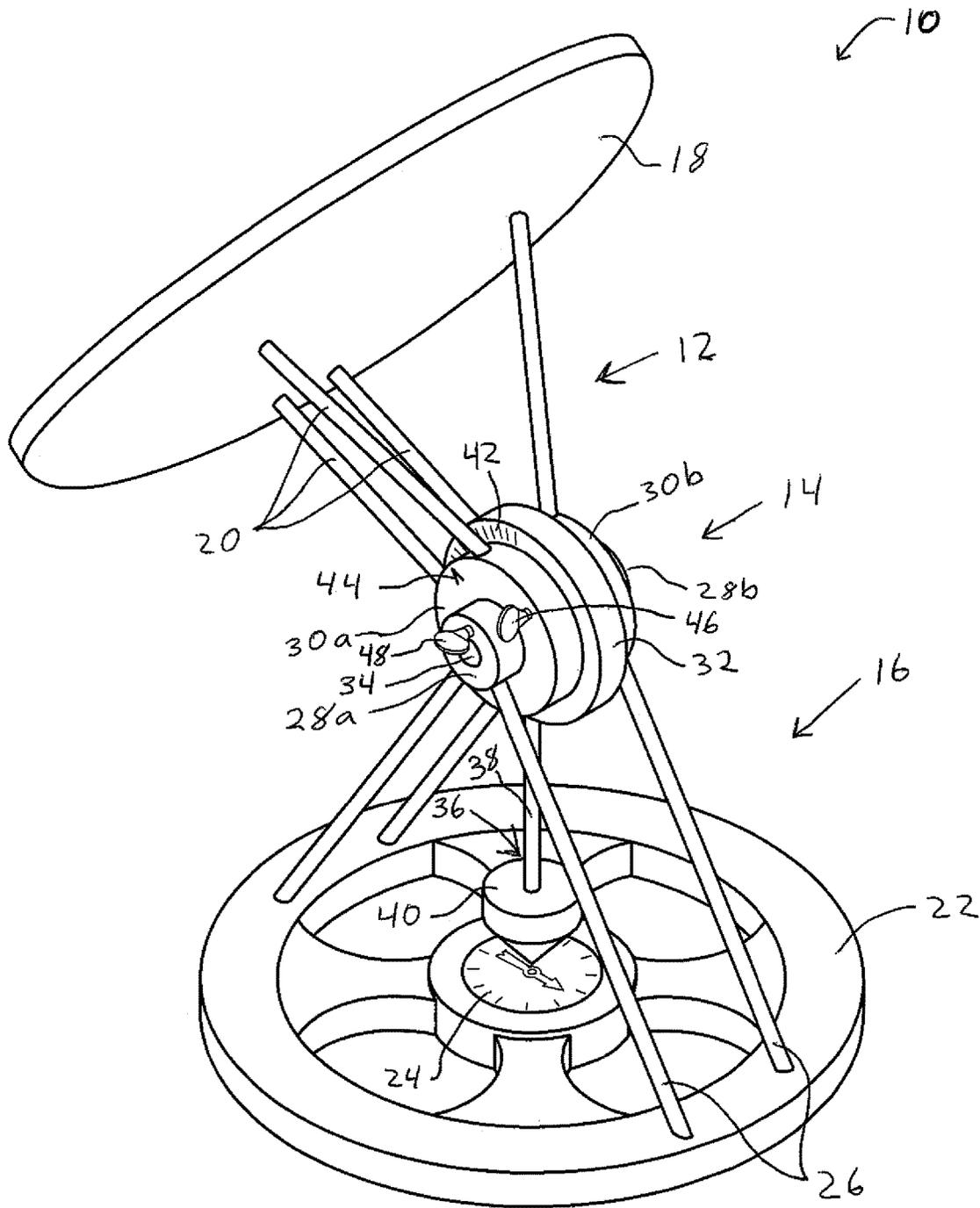
(74) *Attorney, Agent, or Firm* — Seed IP Law Group LLP

(57) **ABSTRACT**

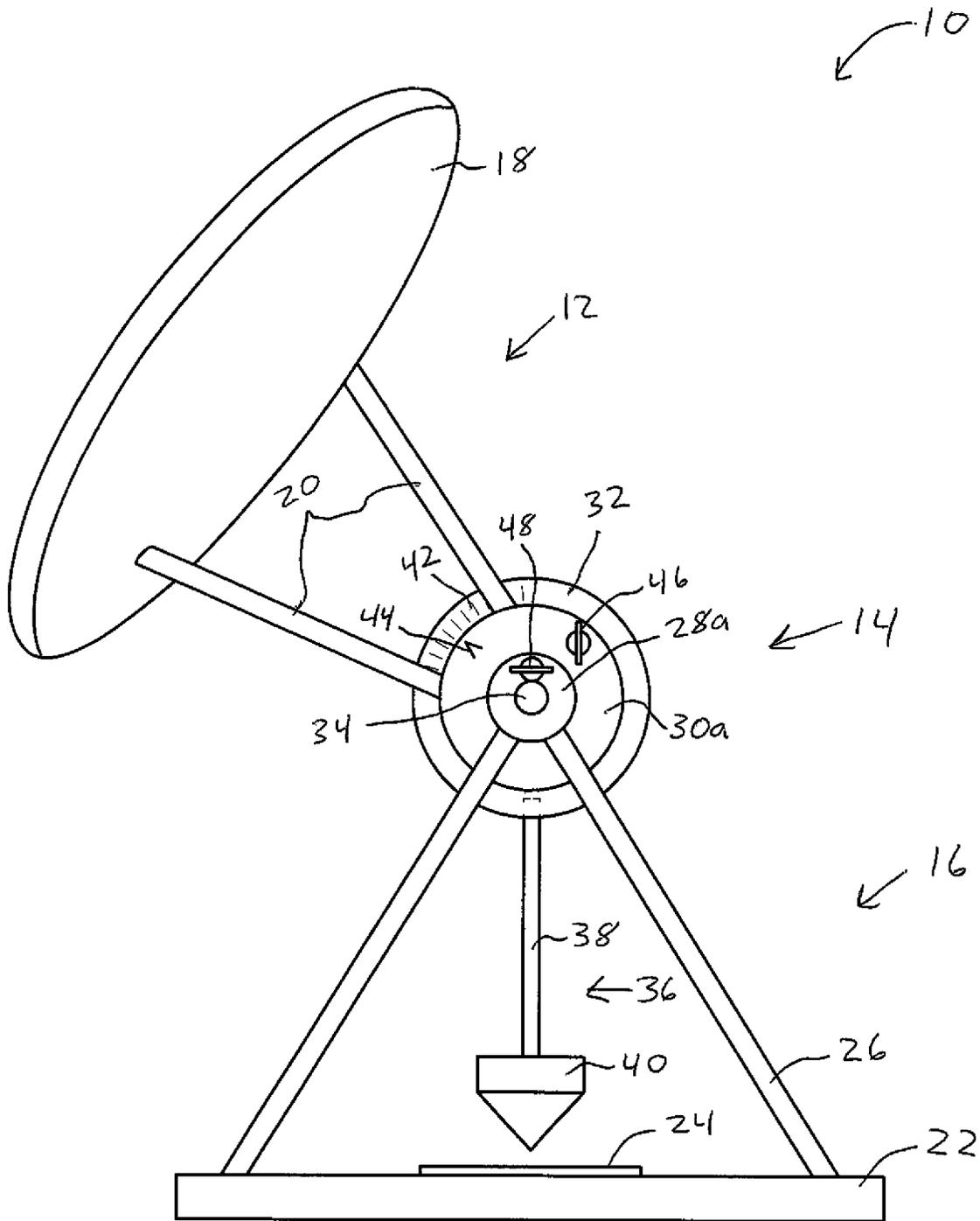
Embodiments are directed towards an antenna mount that is configured with a self-plumbing mast for simplified peaking. The mounting system includes an elevation alignment joint that includes a first member and a second member, which are configured to rotate about a central axis and can be locked into a fixed rotation. A plumb is connected to the first member and an antenna mounting support is connected to the second member such that the antenna position is maintained at an elevation identified on the first member when in the fixed rotation. The mounting system also includes a base assembly that is configured to hold the elevation alignment joint such that the plumb weight self-orients in a vertical, plumb position with the antenna at the desired elevation. The base assembly also includes a compass for aligning the azimuth of the antenna.

**20 Claims, 14 Drawing Sheets**

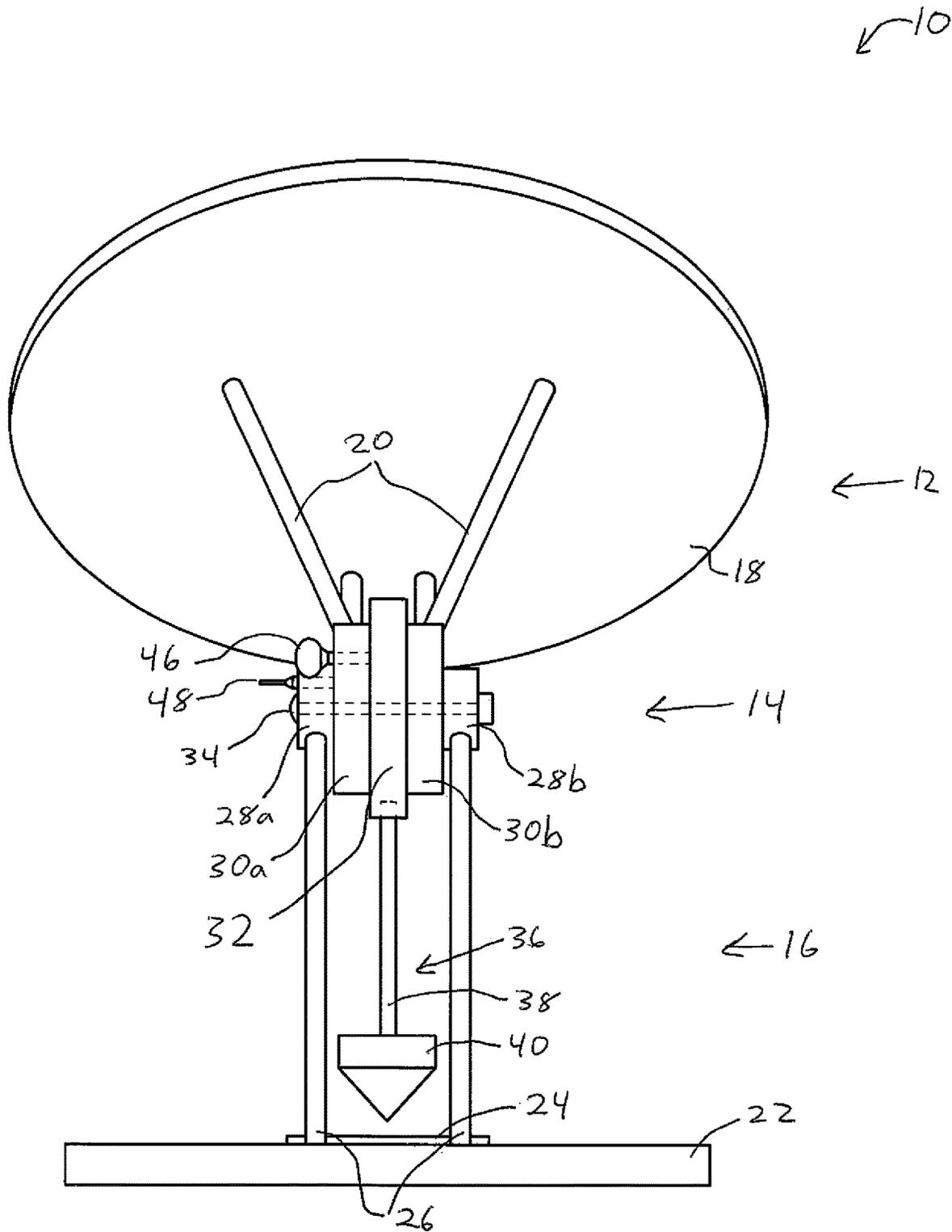




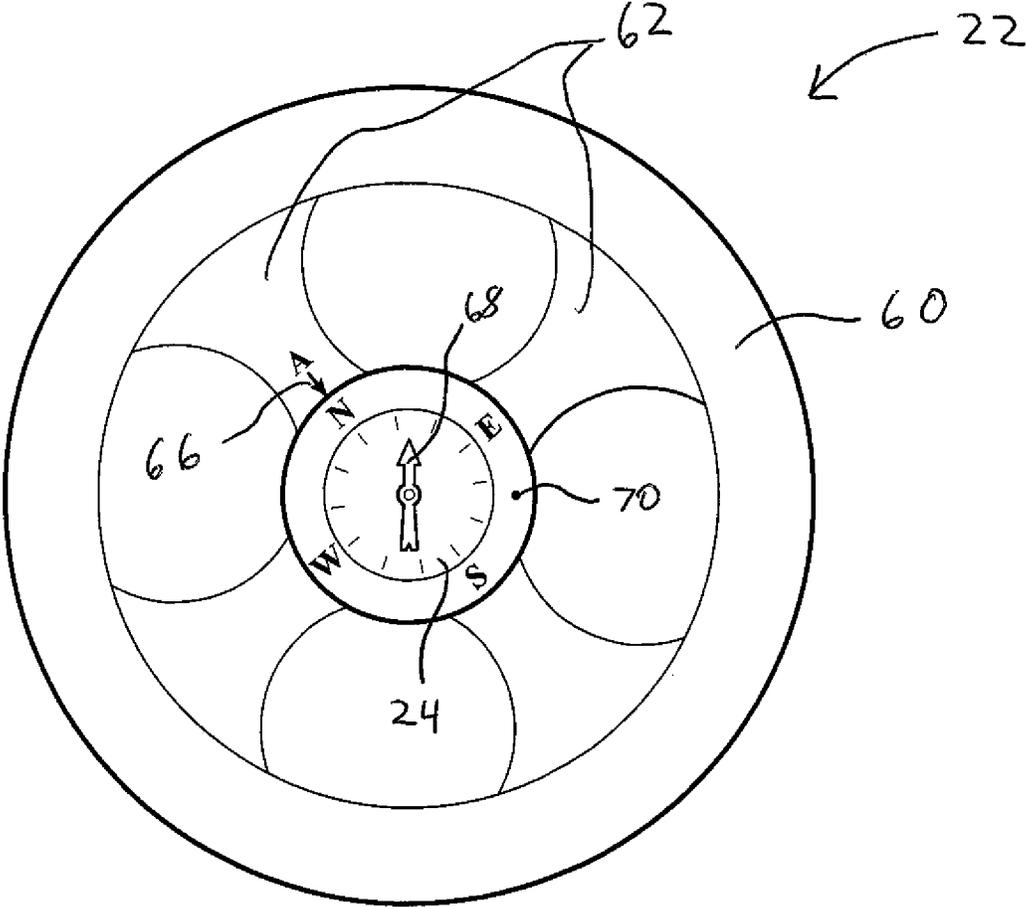
**FIG. 1A**



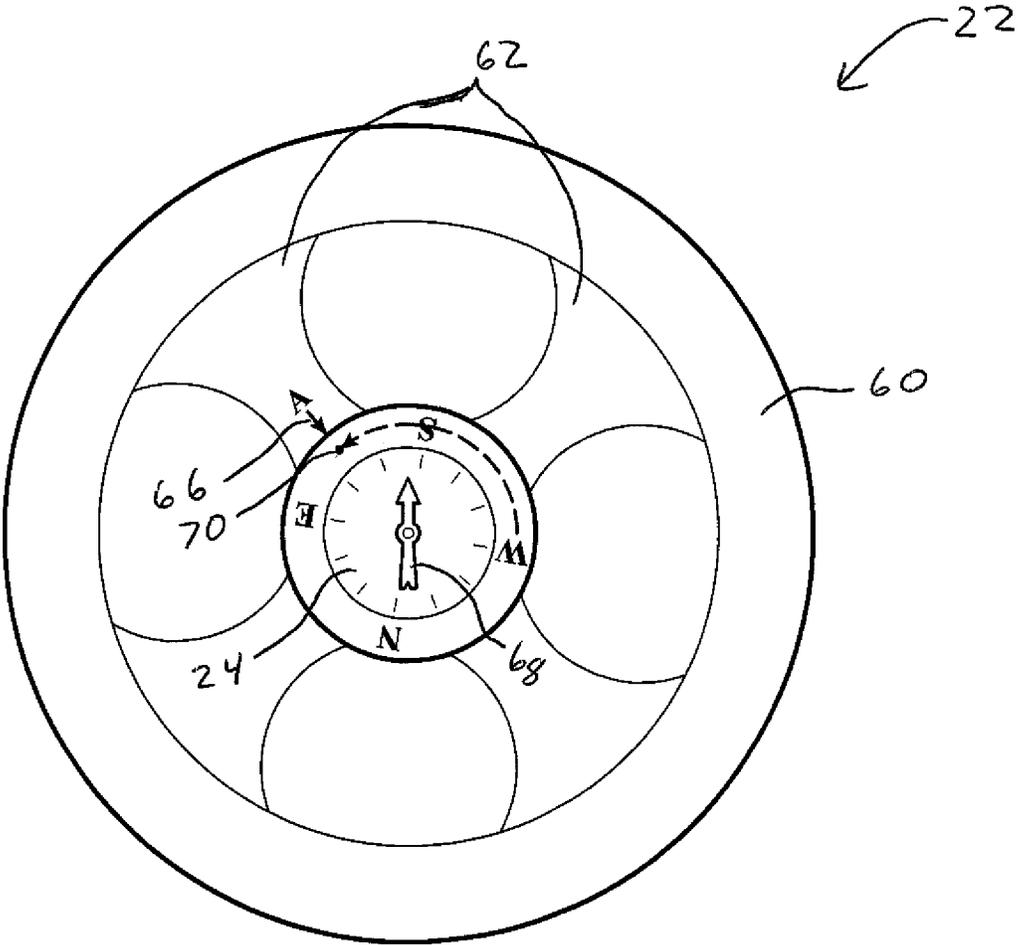
**FIG. 1B**



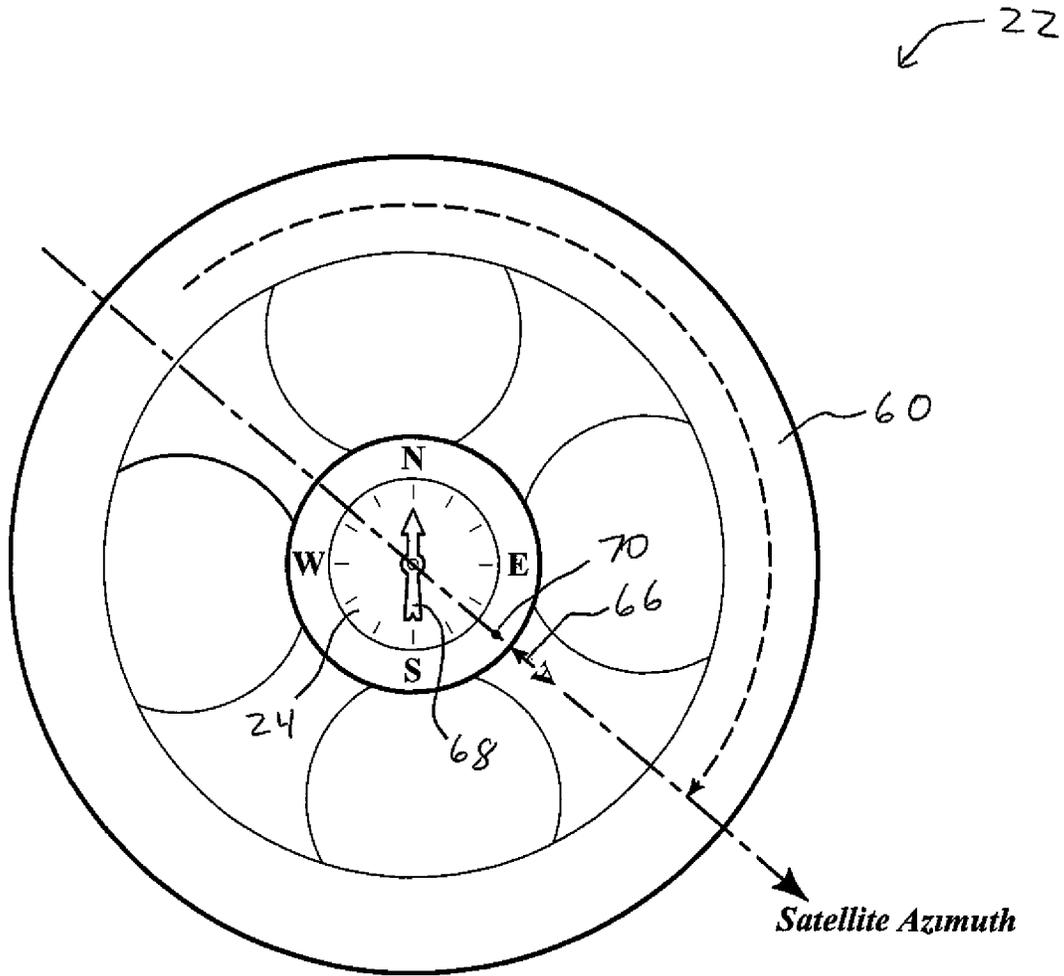
**FIG.1C**



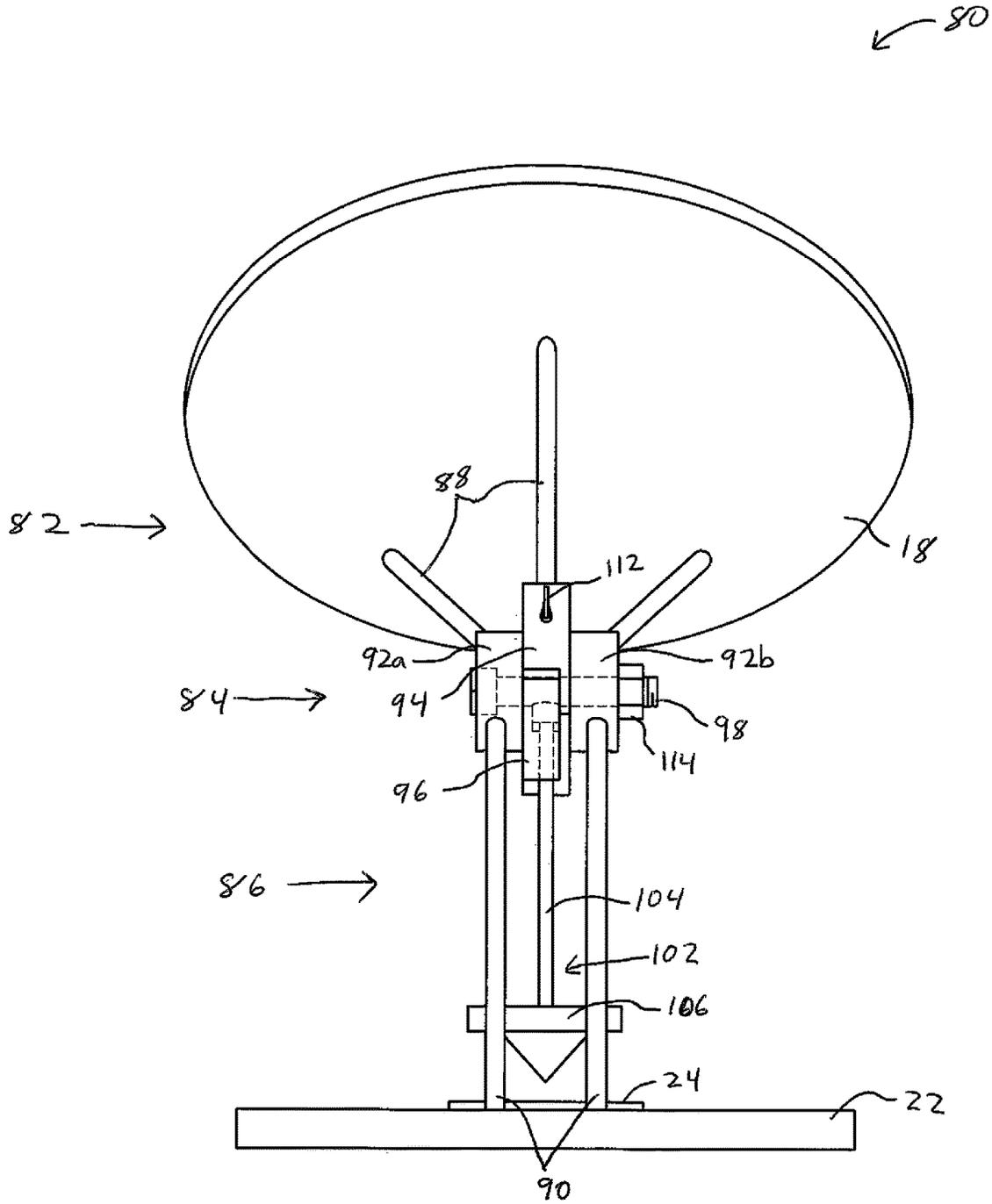
**FIG. 2A**



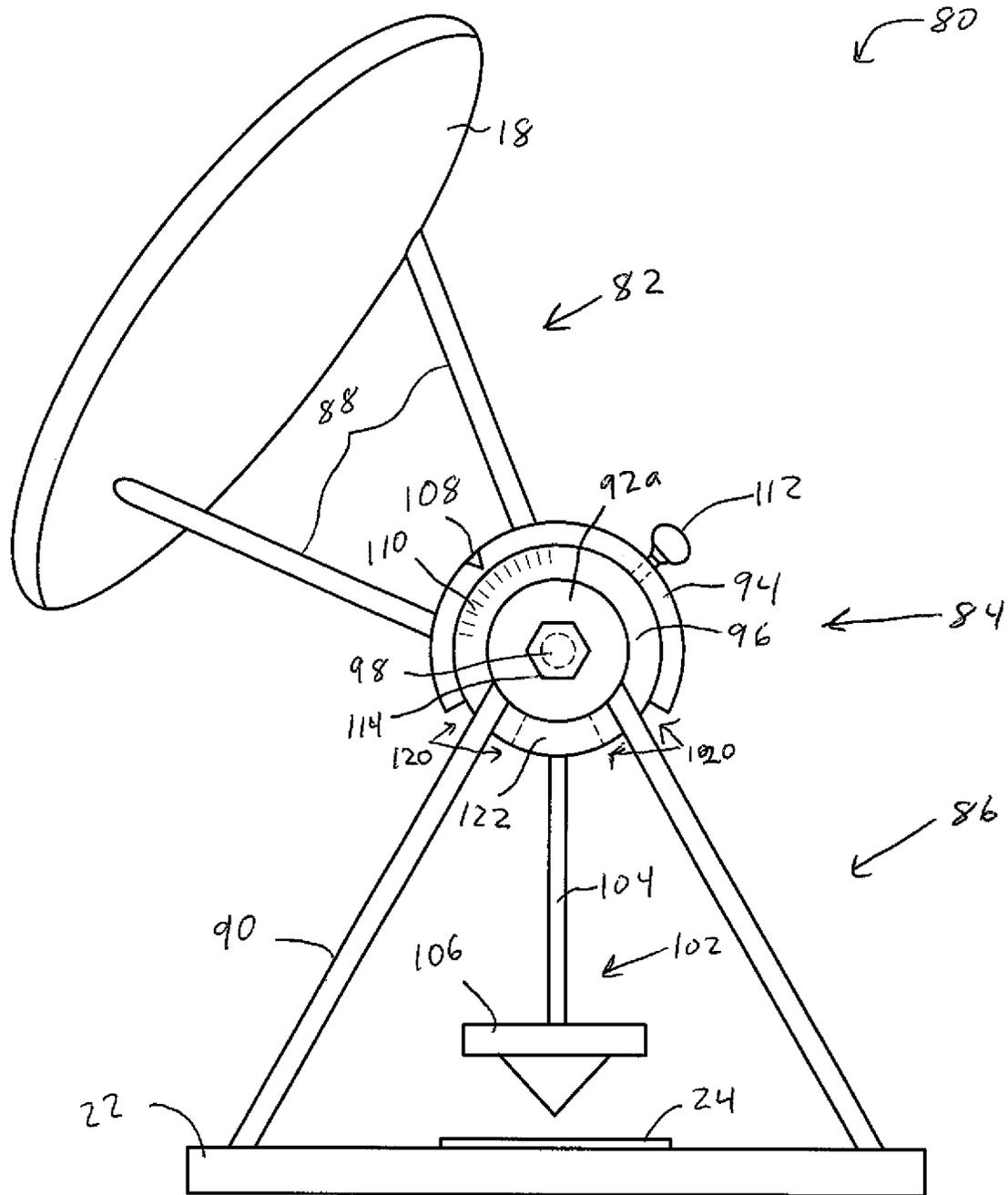
**FIG. 2B**



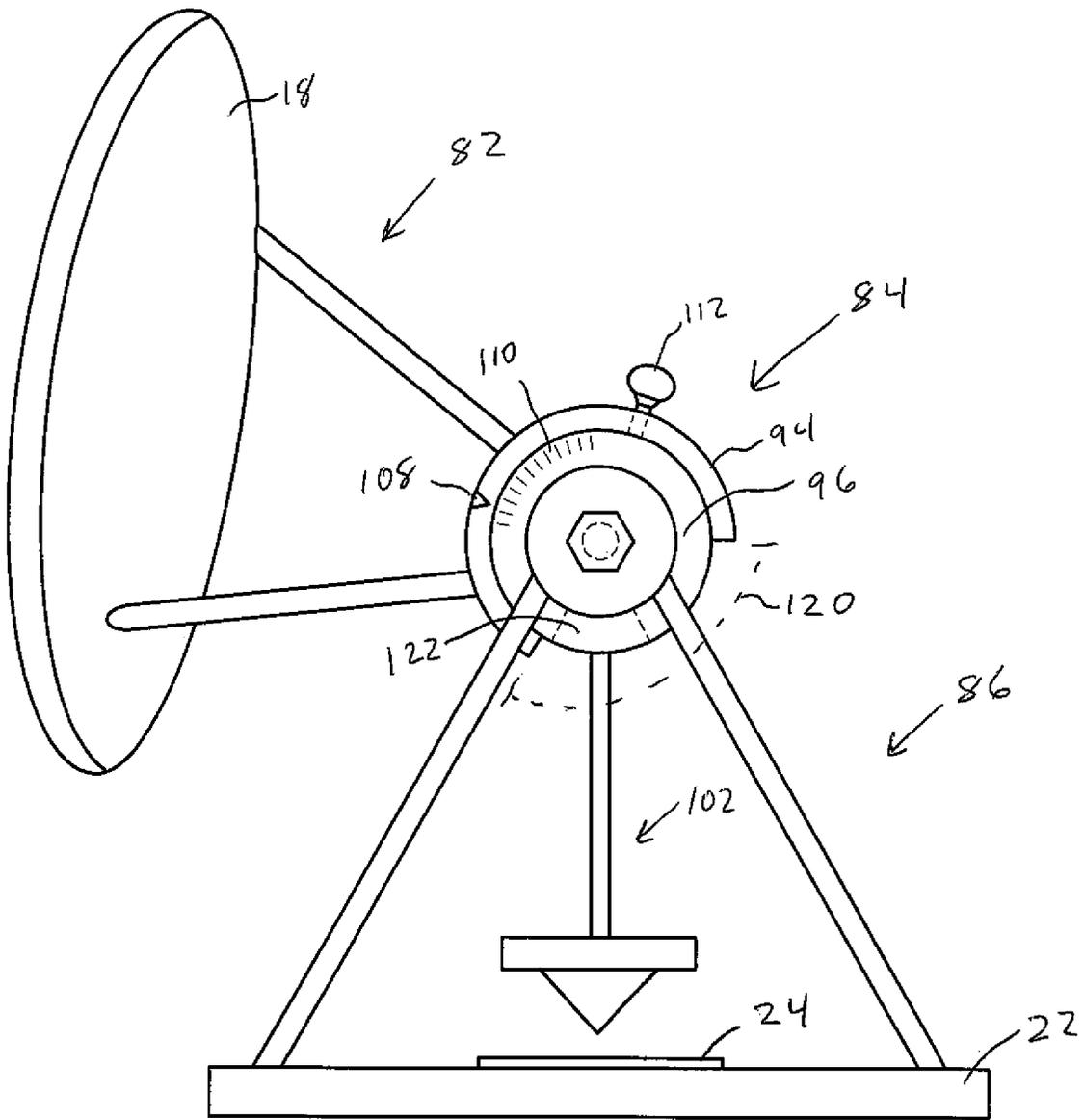
**FIG. 2C**



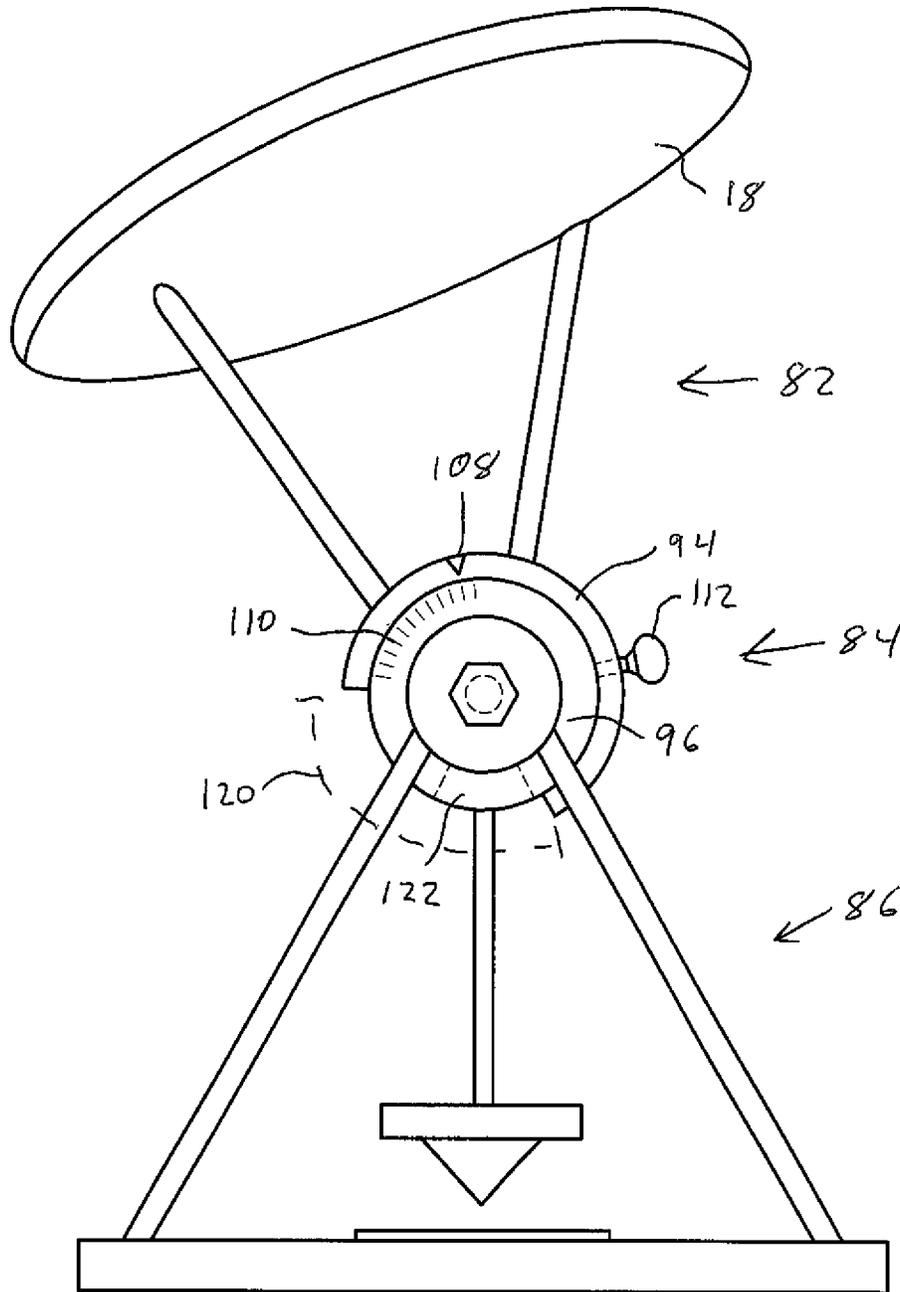
**FIG.3A**



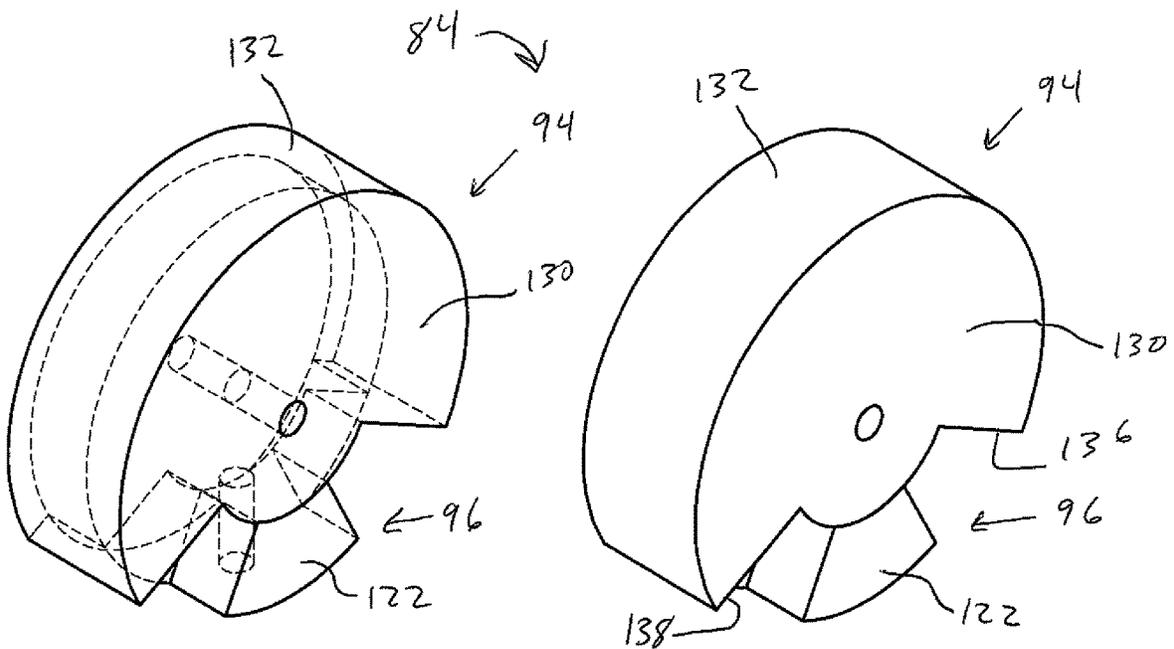
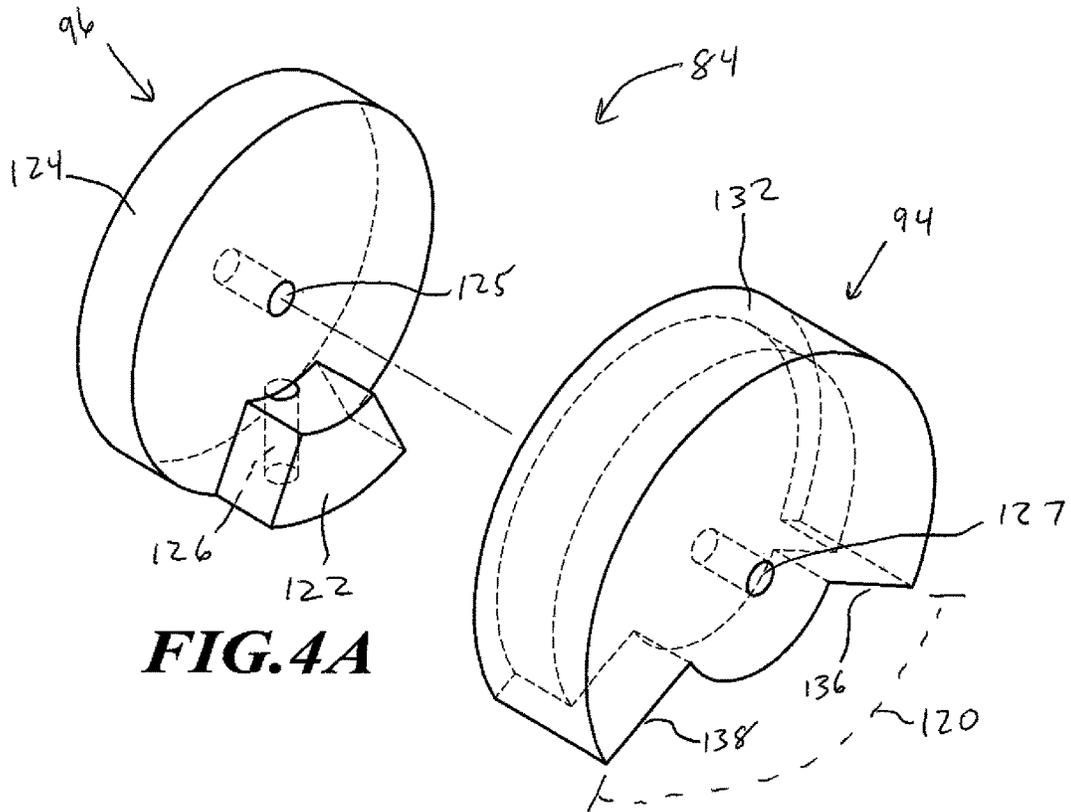
**FIG.3B**

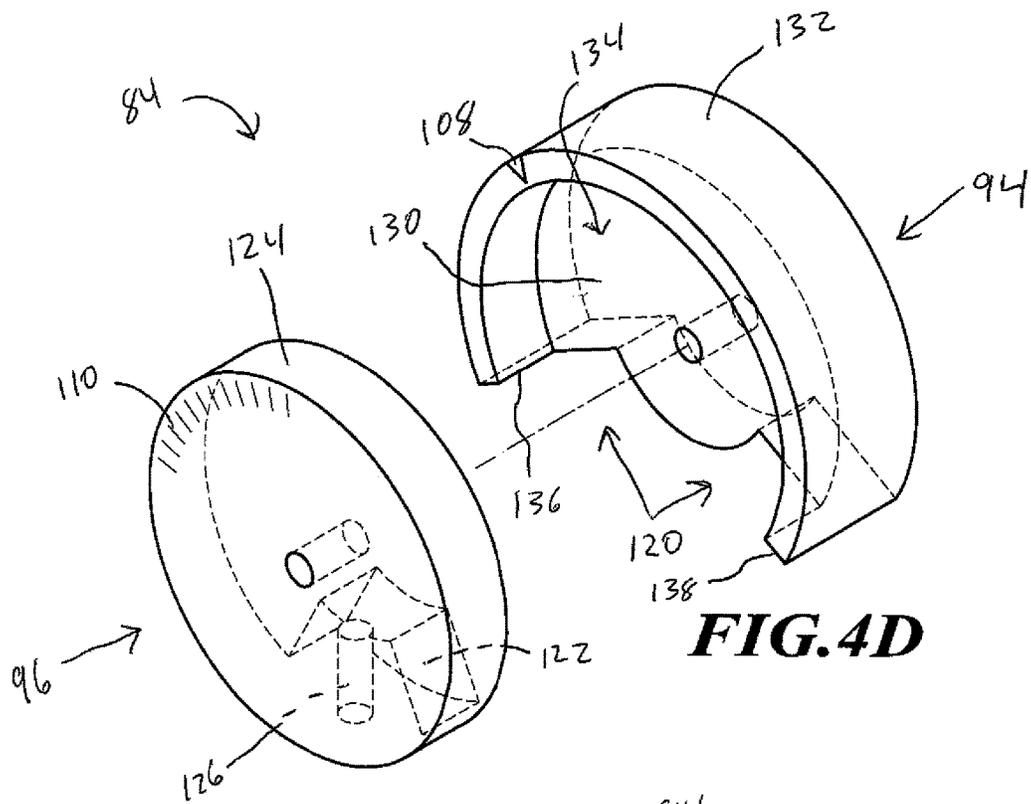


**FIG.3C**

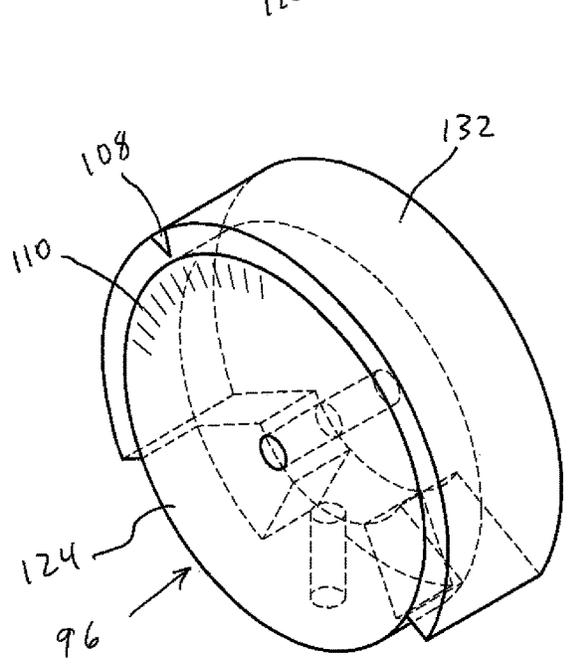


**FIG.3D**

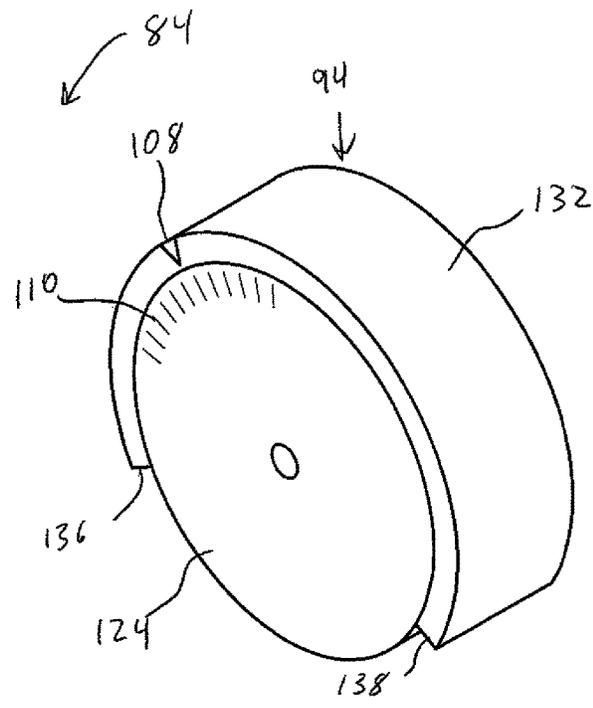




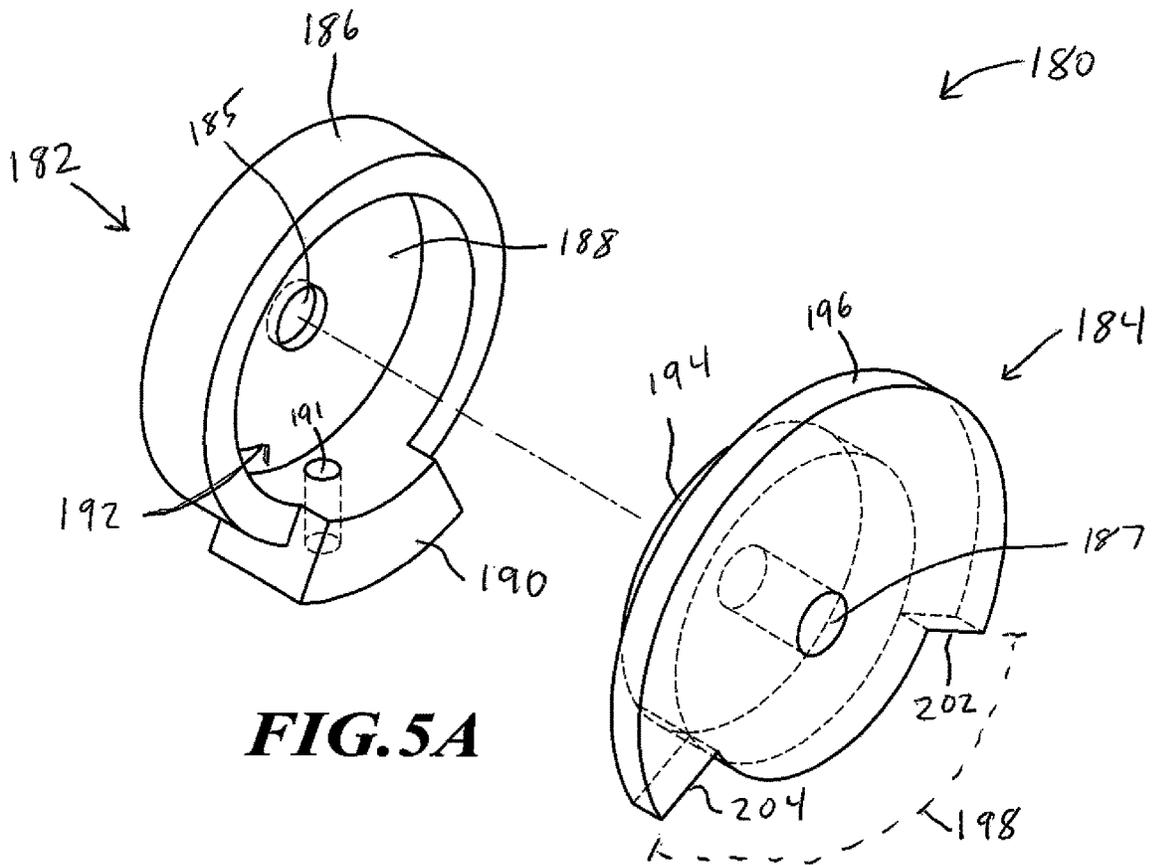
**FIG. 4D**



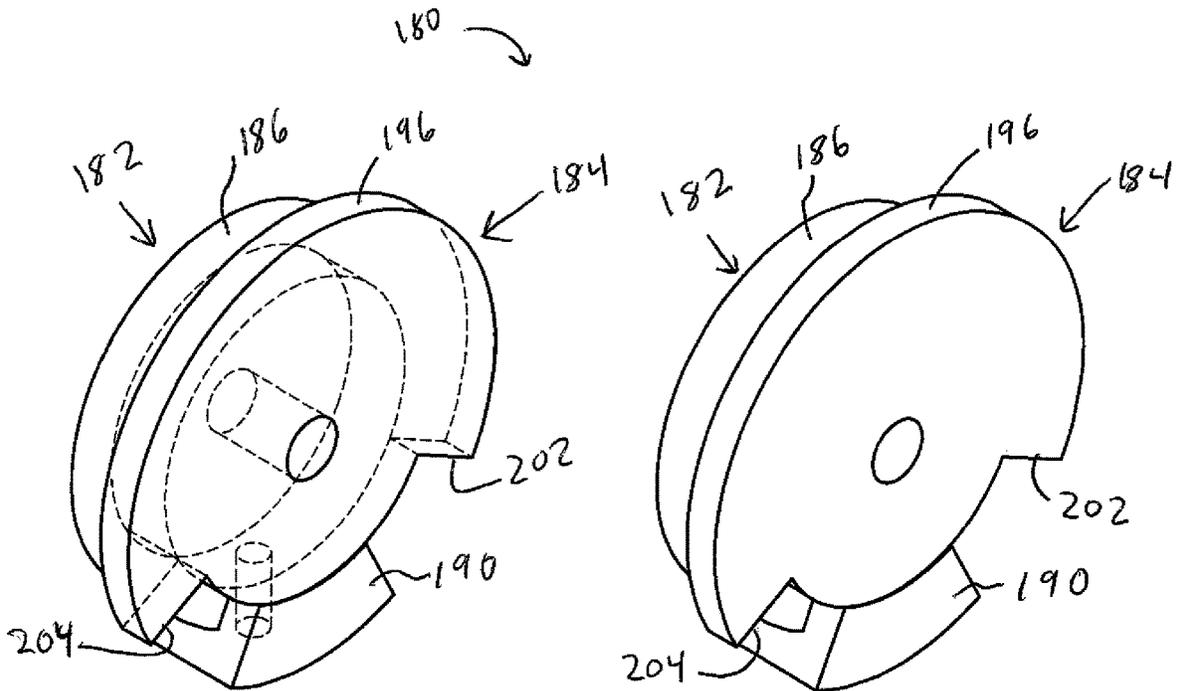
**FIG. 4E**



**FIG. 4F**

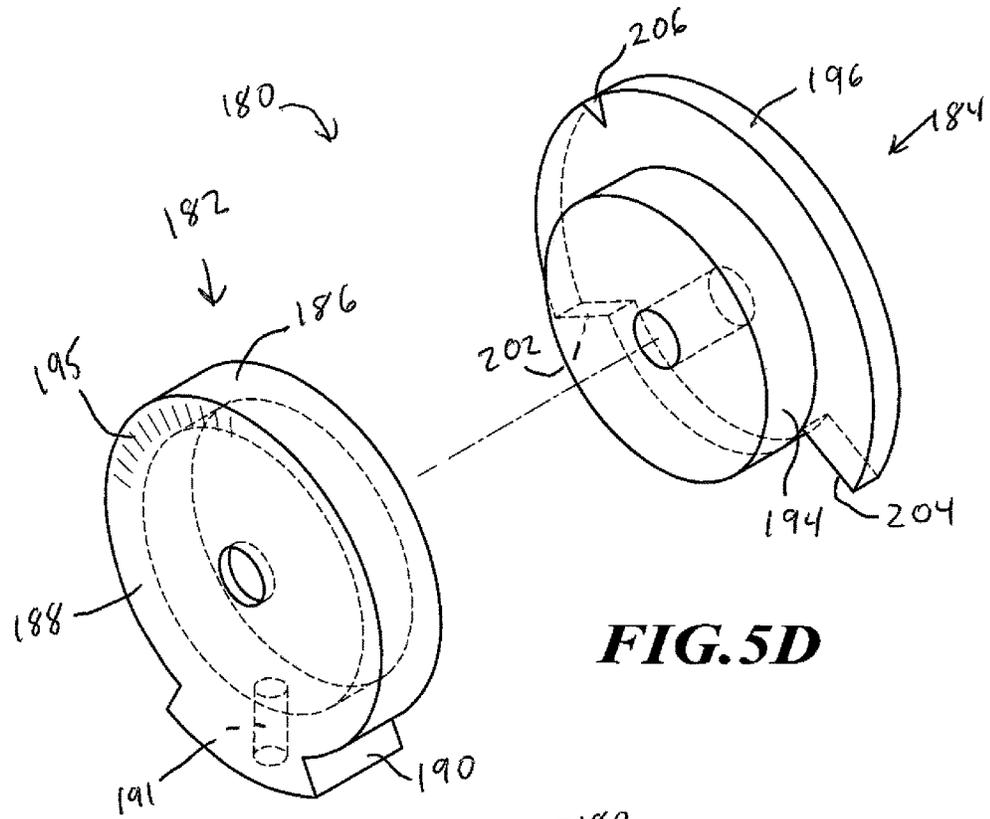


**FIG. 5A**

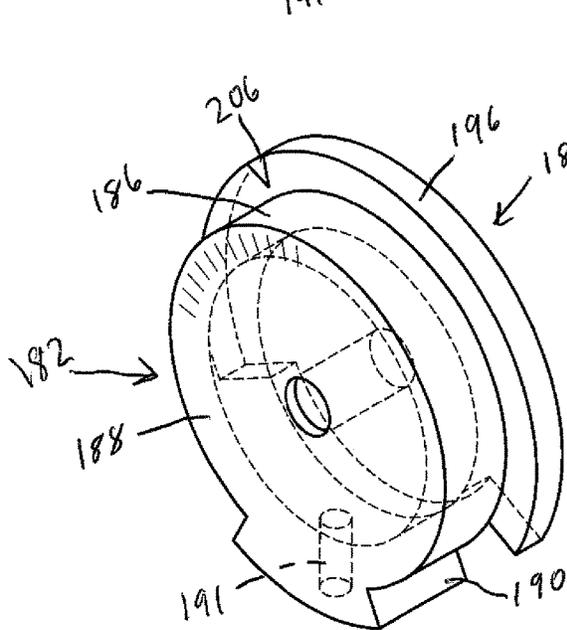


**FIG. 5B**

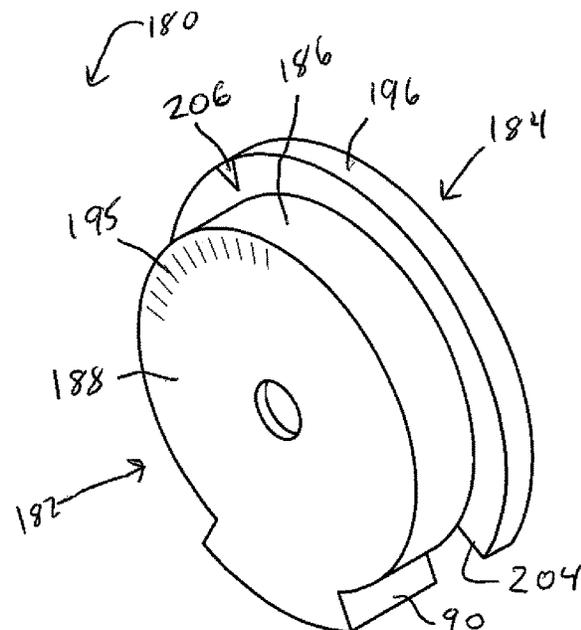
**FIG. 5C**



**FIG. 5D**



**FIG. 5E**



**FIG. 5F**

1

## SIMPLIFIED ANTENNA PEAKING APPARATUS

### BACKGROUND

#### Technical Field

The present disclosure relates generally to antenna assemblies, such as a satellite dish.

#### Description of the Related Art

Antennas, such as satellite dishes, for direct-broadcast satellite (DBS) or broadband antenna systems generally utilize brackets that are mounted to a wall or roof of a user's house. These mounting systems typically require the installer to drill into the user's house and install an antenna mount with such precision as to ensure a plumb mast. Once mounted, the installer peaks the antenna by setting the azimuth and elevation to find the satellite or satellites depending on the antenna utilized. Due to the precision demands of mounting and peaking the antenna, most antennas are installed by a trained technician and not by the user. However, sending a trained technician to install an antenna can be quite costly to the satellite broadcast company, especially with respect to customers that are paying for a very minimal, low cost subscription. It is with respect to these and other considerations that the embodiments described herein have been made.

#### BRIEF SUMMARY

Briefly described, embodiments are directed toward systems, apparatuses, and assemblies for providing an antenna mount that is configured with a self-plumbing mast for simplified peaking. The mounting system includes an elevation alignment joint that includes a first member and a second member, which are configured to rotate about a central axis and can be locked into a fixed rotation. A plumb is connected to the first member and an antenna mounting support is connected to the second member such that the antenna position is maintained at an elevation identified on the first member when in the fixed rotation. The mounting system also includes a base assembly that is configured to hold the elevation alignment joint such that the plumb weight self-ori-ents in a vertical, plumb position with the antenna at the desired elevation. The base assembly also includes a compass for aligning the azimuth of the antenna.

The antenna mounting system described herein provides a low cost solution for a user to easily peak the antenna without mounting to a fixed structure. And since the system does not require mounting to a fixed structure, the antenna mounting system is movable, which provides the additional benefit of allowing the user to set up the antenna in remote locations other than at their home.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Non-limiting and non-exhaustive embodiments are described with reference to the following drawings. In the drawings, like reference numerals refer to like parts throughout the various figures unless otherwise specified.

For a better understanding of the present invention, reference will be made to the following Detailed Description, which is to be read in association with the accompanying drawings:

2

FIGS. 1A-1C are simplified views of an antenna orientation assembly according to one embodiment as described herein;

FIGS. 2A-2C are simplified views of a base and compass of an antenna orientation assembly according to one embodiment as described herein;

FIGS. 3A-3D are simplified views of an antenna orientation assembly according to another embodiment as described herein;

FIGS. 4A-4F are simplified views of an elevation alignment joint of the orientation assembly illustrated in FIGS. 3A-3D according to one embodiment as described herein; and

FIGS. 5A-5F are simplified views of an alternative elevation alignment joint according to one embodiment as described herein.

#### DETAILED DESCRIPTION

The following description, along with the accompanying drawings, sets forth certain specific details in order to provide a thorough understanding of various disclosed embodiments. However, one skilled in the relevant art will recognize that the disclosed embodiments may be practiced in various combinations, without one or more of these specific details, or with other methods, components, devices, materials, etc. In other instances, well-known structures or components that are associated with antenna mounts and assemblies have not been shown or described in order to avoid unnecessarily obscuring descriptions of the embodiments.

Throughout the specification, claims, and drawings, the following terms take the meaning explicitly associated herein, unless the context clearly dictates otherwise. The term "herein" refers to the specification, claims, and drawings associated with the current application. The phrases "in one embodiment," "in another embodiment," "in various embodiments," "in some embodiments," "in other embodiments," and other variations thereof refer to one or more features, structures, functions, limitations, or characteristics of the present disclosure, and are not limited to the same or different embodiments unless the context clearly dictates otherwise. As used herein, the term "or" is an inclusive "or" operator, and is equivalent to the phrases "A or B, or both" or "A or B or C, or any combination thereof," and lists with additional elements are similarly treated. The term "based on" is not exclusive and allows for being based on additional features, functions, aspects, or limitations not described, unless the context clearly dictates otherwise. In addition, throughout the specification, the meaning of "a," "an," and "the" include singular and plural references.

FIGS. 1A-1C are simplified views of an antenna orientation assembly according to one embodiment as described herein. FIG. 1A is a simplified perspective view of an antenna orientation assembly **10**. FIG. 1B is a simplified side view of the antenna orientation assembly **10**. And FIG. 1C is a simplified back view of the antenna orientation assembly **10**.

The antenna orientation assembly **10** includes an antenna assembly **12**, an elevation alignment joint **14**, and a base assembly **16**.

The antenna assembly **12** includes an antenna **18** and a plurality of antenna support members **20**. The antenna **18** is any type of antenna that is configured to receive orbital signals from a satellite, such as a satellite antenna.

The antenna support members **20** are configured to connect the antenna **18** to the rest of the antenna orientation

assembly 10, where a first end of the antenna support members 20 is configured to connect to the antenna and a second end is configured to connect to the elevation alignment joint 14.

The base assembly 16 is a stand that includes a base 22, a compass 24, and base support members 26. The compass 24 and the base 22 are configured to position the antenna 18 at a desired azimuth to peak the received signal from a satellite, which is discussed in more detail below in conjunction with FIGS. 2A-2C. As illustrated in FIG. 1A, the compass 24 is positioned near a central location on the base 22. Although, embodiments are not so limited and the compass 24 may be positioned at other locations on the base 22 or the base assembly 16.

The base support members 26 of the base assembly 16 are configured to connect the elevation alignment joint 14 to the base 22, where a first end of the base support members 26 is configured to connect to the base 22 and a second end is configured to connect to the elevation alignment joint 14. In various embodiments, the base support members 26 are configured to position the elevation alignment joint 14 substantially centered and over the compass 24, such as is illustrated.

The base 22 of the base assembly 16 provides a footing for the antenna orientation assembly 10 to rest on the ground or other surface. Although the base 22 is illustrated as being disk-shaped, embodiments are not so limited. In other embodiments, the base 22 may be square-shaped or some other shape. In some embodiments, the base may also include one or more legs (not illustrated) that can contact the ground to provide additional support for the antenna orientation assembly 10. In at least one such embodiment, the legs may be telescoping or otherwise adjustable to provide another degree in which to adjust the positioning of the antenna 18 to peak the signal from the satellite.

The elevation alignment joint 14 includes one or more base connection members 28a-28b, one or more antenna connection members 30a-30b, and a plumb connection member 32 that are aligned on a central axial bore on axle 34. The elevation alignment joint 14 is configured to attach the antenna assembly 12 to the base assembly 16 while allowing for adjustment of the elevation of the antenna 18. In various embodiments the elevation alignment joint 14 may be considered to be a hinge that allows for adjustment in the antenna elevation direction.

The base connection members 28a-28b of the elevation alignment joint 14 are configured to connect the elevation alignment joint 14 to the base support members 26 of the base assembly 16. Although FIG. 1 illustrates two base connection members 28a-28b, embodiments are not so limited. In other embodiments, only a single base connection member 28a may be utilized. In at least one such embodiment, additional base support members 26 or other configurations of base support members 26 may be utilized to distribute the weight of the elevation alignment joint 14 and the antenna assembly 12 onto the base assembly 16.

The antenna connection members 30a-30b of the elevation alignment joint 14 are configured to connect the antenna support members 20 of the antenna assembly 12 to the elevation alignment joint 14. Although FIG. 1 illustrates two antenna connection members 30a-30b, embodiments are not so limited. In other embodiments, only a single antenna connection member 30a may be utilized. In at least one such embodiment, additional antenna support members 20 or other configurations of antenna support members 20 may be utilized to distribute the weight of the antenna 18 onto the elevation alignment joint 14.

The plumb connection member 32 of the elevation alignment joint 14 is configured to be connected to a plumb 36. The plumb 36, when connected to the plumb connection member 32, is configured to allow gravity to position the plumb 36 in a vertical or plumb position. The plumb 36 includes a plumb mast 38 and a plumb weight 40. One end of the plumb mast 38 connects to the plumb connection member 32 and the other end of the plumb mast 38 connects to the plumb weight 40. The weight of the plumb weight 40 is selected such that the total weight of the plumb 36 is more than the weight of the antenna assembly 12 plus any additional weight from cables or other components attached to the antenna assembly 12, which allows the plumb 36 to self-align in a vertical position when fixed to the antenna assembly 12.

The antenna connection members 30a-30b and the plumb connection member 32 are configured to be flexibly connected so that they freely rotate along the axle 34 relative to the base connection members 28a-28b. In this way, the angle or elevation between the antenna 18 and the plumb mast 38 can be adjusted. At least one of the antenna connection members 30a-30b, e.g., antenna connection member 30a, includes an antenna elevation marker 44. The antenna elevation marker 44 indicates the elevation angle of the antenna 18. Conversely, the plumb connection member 32 includes a plurality of elevation markers 42. The elevation markers 42 indicate different elevations relative to the plumb mast 38.

Since the elevation alignment joint 14 and the plumb connection member 32 are configured to allow the plumb 36 to self-align the plumb mast 38 in a vertical position, the elevation markers 42 indicate the possible elevation positions of the antenna 18. Moreover, since the elevation alignment joint 14 and the antenna connection members 30a-30b are configured so that the antenna connection members 30a-30b freely rotate about the axle 34, the elevation of the antenna 18 can be adjusted with respect to the plumb 36 by aligning the antenna elevation marker 44 on the antenna connection member 30a with the desired elevation on the elevation markers 42 on the plumb connection member 32. In various embodiments, the user is provided the desired elevation based on the geographical location of the antenna orientation assembly 10 and the position of the satellite that is transmitting the orbital signals to the antenna 18.

It should be recognized that in some situations the plumb may not be fully vertical, in which case the positioning of the elevation markers 42 during manufacture may be adjusted to account for any angle created when the plumb hangs free with the weight of the antenna assembly. In other embodiments, the desired elevation provided to the user may account for the plumb angle variation.

Once the antenna assembly 12 is positioned such that the antenna elevation marker 44 on the antenna connection member 30a of the elevation alignment joint 14 is aligned with the desired elevation on the elevation markers 42 on the plumb connection member 32, a first locking mechanism 46 is engaged. Engagement of the first locking mechanism 46 fixes the position of the antenna connection members 30a-30b with the plumb connection member 32. In this way, the elevation angle of the antenna 18 is secured relative to the plumb 36.

In the illustrated example, the first locking mechanism 46 is a set screw through the antenna connection member 30a, and when engaged exerts pressure on the plumb connection member 32 to secure the positions of the antenna connection members 30a-30b and the plumb connection member 32

relative to one another. It should be recognized that other types of locking mechanisms between the antenna connection members 30a-30b and the plumb connection member 32 may also be employed.

With the first locking mechanism 46 engaged, and the second locking mechanism 48 disengaged, the plumb 36 is allowed to self-align in a vertical position, which aligns the antenna 18 into the desired elevation. Once the plumb 36 is self-aligned in a vertical position, the second locking mechanism 48 is engaged to fix the position of the antenna connection members 30a-30b and the plumb connection member 32 relative to the base connection members 28a-28b.

In the illustrated example, the second locking mechanism 48 is a set screw through the base connection member 28a, and when engaged exerts pressure on the antenna connection member 30a to secure the position of the locked antenna connection member 20 and plumb connection member 32 relative to the base connection members 28a-28b. It should be recognized that other types of locking mechanisms between the base connection members 28a-28b and the locked antenna connection members 30a-22b and the plumb connection member 32 may also be employed.

FIGS. 2A-2C are simplified views of a base and compass of an antenna orientation assembly according to one embodiment as described herein.

FIG. 2A illustrates a base 22 of the base assembly 16 shown above in FIGS. 1A-1C. The base 22 includes an outer portion 60 and an inner portion 62. A compass 24 is positioned on the inner portion 62, such as in a substantially central portion of the base 22. The inner portion 62 also includes an azimuth designation marker 66. The azimuth designation marker 66 indicated the azimuth of the antenna, when the base 22 is rotated about a rotational axis of a pointer 68 of the compass 24. The azimuth designation marker 66 is also aligned with the elevation axis of the antenna 18 to indicate pointing direction of the antenna towards the satellite(s) for signal peaking. The pointer 68 is configured to align with magnetic north.

As discussed above, a user is provided a desired azimuth for the antenna to receive signals from a satellite, which is illustrated by angle marker 70 on the compass 24. The user rotates the compass 24 until the angle marker 70 is aligned with the azimuth designation marker 66, which is illustrated in FIG. 2B. In some embodiments, only an outer rim of the compass 24 is rotated about the rotational axis of the pointer 68. Once the angle marker 70 is aligned with the desired azimuth marker 68, the user rotates the base 22 until the pointer 68 is aligned with north on the compass 24. In some embodiments, the compass may include additional functionality to adjust the declination between magnetic north and true north based on the current location of the antenna orientation assembly on the earth. In other embodiments, the desired azimuth provided to the user already includes the declination adjustment so that the user only has to rotate the base 22 and align the pointer 68 with north and make no other calculations or adjustments to the azimuth.

It should be recognized that the user can adjust the elevation of the antenna first such as discussed herein, followed by adjusting the azimuth. Or the user can first adjust the azimuth, followed by the elevation.

FIGS. 3A-3D are simplified views of an antenna orientation assembly according to another embodiment as described herein. FIG. 3A is a simplified back view of an antenna orientation assembly 80. FIG. 3B is a simplified side view of the antenna orientation assembly 80. And FIGS. 3C

and 3D are simplified side views of the antenna orientation assembly 80 with an antenna 18 positioned at different elevations.

The antenna orientation assembly 80 includes an antenna assembly 82, an elevation alignment joint 84, and a base assembly 86.

The antenna assembly 82 includes an antenna 18 and a plurality of antenna support members 88. The antenna support members 88 are configured to connect the antenna 18 to the rest of the antenna orientation assembly 80, where a first end of the antenna support members 88 is configured to connect to the antenna 18 and a second end is configured to connect to the elevation alignment joint 84.

The base assembly 86 includes a base 22, a compass 24, and base support members 90. The base 22 and the compass 24 are embodiments of the base and compass described above, such that the compass 24 and the base 22 are configured to position the antenna 18 at a desired azimuth to peak the received signal from a satellite, which is discussed in more detail above in conjunction with FIGS. 2A-2C. Similar to what is illustrated in FIG. 1A, the compass 24 is positioned near a central location on the base 22. Although, embodiments are not so limited and the compass 24 may be positioned at other locations on the base 22 or the base assembly 86.

The base support members 90 of the base assembly 86 are configured to connect the elevation alignment joint 84 to the base 22, where a first end of the base support members 90 is configured to connect to the base 22 and a second end is configured to connect to the elevation alignment joint 84. In various embodiments, the base support members 90 are configured to position the elevation alignment joint 84 substantially centered and over the compass 24, such as is illustrated.

The elevation alignment joint 84 includes base connection members 28a-28b, an antenna connection member 94, and a plumb connection member 96 that are aligned on axle 98 along a central axis. The elevation alignment joint 84 is configured to attach the antenna assembly 82 to the base assembly 86 while allowing for adjustment of the elevation of the antenna 18.

The base connection members 92a-92b of the elevation alignment joint 84 are configured to connect the elevation alignment joint 84 to the base support members 90 of the base assembly 86. The antenna connection member 94 of the elevation alignment joint 84 is configured to connect the antenna support members 88 of the antenna assembly 82 to the elevation alignment joint 84.

The plumb connection member 96 of the elevation alignment joint 84 is configured to be connected to a plumb 102. The plumb 102, when connected to the plumb connection member 96, is configured to allow gravity to position the plumb 102 in a vertical or plumb position. The plumb 102 includes a plumb mast 104 and a plumb weight 106. One end of the plumb mast 104 connects to the plumb connection member 96 and the other end of the plumb mast 104 connects to the plumb weight 106. The weight of the plumb weight 106 is selected such that the total weight of the plumb 102 is more than the weight of the antenna assembly 82 plus any additional weight from cables or other components attached to the antenna assembly 82, which allows the plumb 102 to self-align in a vertical position when fixed to the antenna assembly 82.

The antenna connection member 94 and the plumb connection member 96 are configured to freely rotate along the axle 98 relative to the base connection members 92a-92b. In this way, the angle or elevation between the antenna 18 and

the plumb mast **104** can be adjusted. The elevation alignment joint **84** is discussed in more detail below in conjunction with FIGS. 4A-4F, but briefly, in some embodiments, the antenna connection member **94** of the elevation alignment joint **84** is disk-like with a mouth perpendicular to the central axis and the plumb connection member **96** of the elevation alignment joint **84** is disk-like with an elevation range guide (also referred to as stopping portion of the plumb connection member **96**) sized to fit inside the mouth of the antenna connection member **94** and to allow the antenna connection member **94** to move relative to the plumb connection member **96** between a minimum and maximum antenna elevation. In some embodiments, the antenna connection member **94** is ring-shaped with a mouth and the plumb connection member **96** is disk-shaped and sized to fit inside the antenna connection member **94** with the plumb mast **104** of the plumb **102** passing through the mouth of the antenna connection member **94**.

The antenna connection member **94** includes an antenna elevation marker **108**. The antenna elevation marker **108** indicates the elevational direction of the antenna **18**. Conversely, the plumb connection member **96** includes a plurality of elevation markers **110**. The elevation markers **110** indicate different elevations relative to the plumb mast **104**.

Since the elevation alignment joint **84** and the plumb connection member **96** are configured to allow the plumb **102** to self-align the plumb mast **104** in a vertical position, the elevation markers **110** indicate the possible elevation positions of the antenna **18**. Moreover, since the elevation alignment joint **84** and the antenna connection member **94** are configured to allow the antenna connection member **94** to freely rotate about the axle **98**, the elevation of the antenna **18** can be adjusted with respect to the plumb **102** by aligning the antenna elevation marker **108** on the antenna connection member **94** with the desired elevation on the elevation markers **110** on the plumb connection member **96**. As mentioned above, the user is provided the desired elevation based on the geographical location of the antenna orientation assembly **80** and the position of the satellite that is transmitting the orbital signals to the antenna **18**.

Once the antenna assembly **82** is positioned such that the antenna elevation maker **108** on the antenna connection member **94** of the elevation alignment joint **84** is aligned with the desired elevation on the elevation markers **110** on the plumb connection member **96**, a first locking mechanism **112** is engaged. Engagement of the first locking mechanism **112** fixes the position of the antenna connection member **94** with the plumb connection member **96**. In this way, the elevation angle of the antenna **18** is secured relative to the plumb **102**.

In the illustrated example, the first locking mechanism **112** is a set screw through the antenna connection member **94**, and when engaged exerts pressure on the plumb connection member **96** to secure the position of the antenna connection member **94** and the plumb connection member **96** relative to one another. It should be recognized that other types of locking mechanisms between the antenna connection member **94** and the plumb connection member **96** may also be employed. For example, the plumb mast **104** may act as a set screw that passes through the plumb connection member **96** to exert pressure on the antenna connection member **94** when engaged.

With the first locking mechanism **112** engaged, and the second locking mechanism **114** disengaged, the plumb **102** is allowed to self-align in a vertical position, which aligns the antenna **18** into the desired elevation. Once the plumb **102** is self-aligned in a vertical position, the second locking

mechanism **114** is engaged to fix the position of the antenna connection member **94** and the plumb connection member **96** relative to the base connection members **92a-92b**.

In the illustrated example, the second locking mechanism **114** is a nut that screws onto the axle **98**, which secures the antenna connection member **94** and the plumb connection member **96** between the base connection members **92a-92b**. It should be recognized that other types of locking mechanisms between the base connection members **92a-92b** and the locked antenna connection member **94** and the plumb connection member **96** may also be employed. For example, a set screw (not illustrated) through the base connection member **92a** may be utilized, and when engaged exerts pressure on the plumb connection member **96** to secure the position of the locked antenna connection member **94** and plumb connection member **96** relative to the base connection members **92a-92b**. As another example, a set screw (not illustrated) through the base connection member **92b** may be utilized, and when engaged exerts pressure on the antenna connection member **94** to secure the position of the locked antenna connection member **94** and plumb connection member **96** relative to the base connection members **92a-92b**.

FIG. 3C illustrates the antenna orientation assembly **80** with the antenna **18** positioned at a minimum elevation, and FIG. 3D illustrates the antenna orientation assembly **80** with the antenna **18** positioned at a maximum elevation. As shown in more detail below in conjunction with FIGS. 4A-4F, the antenna connection member **94** includes a mouth portion or opening **120** to allow a stopping portion **122** of the plumb connection member **96** move between a minimum antenna elevation position (FIG. 3C) and a maximum antenna elevation position (FIG. 3D). The opening **120** is sized larger than the diameter of the plumb mast **104** to limit the angle between the plumb weight **102** and the antenna **18** between the minimum and maximum elevation.

FIGS. 4A-4F are simplified views of an elevation alignment joint of the orientation assembly illustrated in FIGS. 3A-3D according to one embodiment as described herein. The elevation alignment joint **84** includes the plumb connection member **96** and the antenna connection member **94**, as discussed above—however, the base connection members are not shown in FIGS. 4A-4F for each of illustration. Similarly, the plumb and antenna support members described above are not shown as being connected to the plumb connection member **96** and the antenna connection member **94**, respectively, for ease of illustration.

The antenna connection member **94** includes an inner disk **130** and an outer ring **132**. The inner disk **130** includes a central axial bore **127** about which the antenna connection member **94** can rotate on the axle **98** in FIG. 3A. The outer ring **132** extends away from the inner disk **130** along the central axis to form a cavity **134**. The outer ring **132** includes the antenna elevation marker **108** in the same direction in which the outer ring **132** extends away from the inner disk **130**, which is to illustrate the elevation of the antenna relative to the plumb attached to the plumb connection member **96**. The outer ring **132** is not a complete ring, but instead includes opening **120** having a first edge **136** and a second edge **138**.

The plumb connection member **96** includes a disk **124** and a stopping portion **122**. The disk **124** includes a central axial bore **125** about which the plumb connection member **96** can rotate on the axle **98** in FIG. 3A. The disk **124** is configured to fit into the cavity **134** of the antenna connection member **94** with the central axial bore **125** of the disk **124** aligning with the central axial bore **127** of the antenna connection member **94**.

The stopping portion 122 extends away from the disk 124 in the same direction as the central axis of the disk 124. The stopping portion 122 is positioned on the disk 124 such that, when the disk 124 of the plumb connection member 96 is positioned in the cavity 134 of the antenna connection member 94, the stopping portion 122 is positioned in the opening 120 of the outer ring 132 of the antenna connection member 94. In this way, the antenna connection member 94 can rotate about the central axis of the plumb connection member 96. As the antenna connection member 94 rotates relative to the plumb connection member 96, the first edge 136 of the opening 120 on the outer ring 132 of the antenna connection member 94 abuts the stopping portion 122 on the plumb connection member 96 at a minimum elevation for the antenna. Conversely, as the antenna connection member 94 is rotated in the opposite direction relative to the plumb connection member 96, the second edge 138 of the opening 120 on the outer ring 132 of the antenna connection member 94 abuts the stopping portion 122 on the plumb connection member 96 at a maximum elevation for the antenna.

The plumb connection member 96 also includes an aperture or connection point 126 for a plumb (not illustrated) to connect to the plumb connection member 96, as described herein. In some embodiments, the connection point 126 is centered perpendicular to the central axis of the disk 124 between the disk 124 and the stopping portion 122 (as illustrated), or fully in the stopping portion 122 (not illustrated). This allows, in some embodiments, for the plumb to act as a locking mechanism against the antenna connection member 94, as discussed above. The disk 124 includes a plurality of elevation markers 110 on a size opposite of the extension of the stopping portion 122.

FIGS. 5A-5F are simplified views of an alternative elevation alignment joint 180 according to one embodiment as described herein. The elevation alignment joint 180 includes a plumb connection member 182 and an antenna connection member 184. In various embodiments, the elevation alignment joint 180 may be utilized in the antenna orientation assembly 10 in FIGS. 3A-3D—however, the base connection members are not shown in FIGS. 5A-5F for each of illustration. Similarly, the plumb and antenna support members described above are not shown as being connected to the plumb connection member 182 and the antenna connection member 184, respectively, for ease of illustration.

The plumb connection member 182 includes an outer ring 186, an inner disk 188, and an elevation stopper 190. The inner disk 188 includes a central axial bore 185 about which the plumb connection member 182 can rotate on the axle 98 in FIG. 3A. The inner disk 188 also includes an aperture or connection point 191 for a plumb (not illustrated) to connect to the plumb connection member 182, as described herein. The outer ring 186 extends away from the inner disk 188 along a central axis to form a cavity 192. The elevation stopper 190 extends away from the outer ring 186 in the same direction as the central axis of the outer ring 186. The inner disk 188 includes a plurality of elevation markers 195 on a size opposite of the extension of the outer ring 186 away from the inner disk 188.

The antenna connection member 184 includes an inner disk 194 and an elevation adjustment member 196. The inner disk 194 along with the elevation adjustment member 196 includes a central axial bore 187 about which the antenna connection member 184 can rotate on the axle 98 in FIG. 3A. The inner disk 194 is configured to fit into the cavity 192 of the plumb connection member 182 with a central axis of the inner disk 194 aligning with the central axis of the outer ring 186 of the plumb connection member

182. The elevation adjustment member 196 is a disk-like shape that includes an opening 198 having a first edge 202 and a second edge 204. The elevation adjustment member 196 also includes an antenna elevation marker 206 on a same side as the inner disk 194 to illustrate the elevation of the antenna relative to the plumb attached to the plumb connection member 182.

When the inner disk 194 of the antenna connection member 184 is positioned in the cavity 192 of the plumb connection member 182 with the stopper 190 of the plumb connection member 182 positioned in the opening 198 of the elevation adjustment member 196, the antenna connection member 184 can rotate about the central axis of the plumb connection member 182. As the antenna connection member 184 rotates relative to the plumb connection member 184, the first edge 202 of the opening 198 on the elevation adjustment member 196 abuts the elevation stopper 190 on the plumb connection member 184 at a minimum elevation for the antenna. Conversely, as the antenna connection member 184 is rotated in the opposite direction relative to the plumb connection member 184, the second edge 204 of the opening 198 on the elevation adjustment member 196 abuts the elevation stopper 190 on the plumb connection member 184 at a maximum elevation for the antenna.

In some embodiments, weights or anchors (not illustrated) may be utilized by the user to secure the antenna orientation assembly to the ground or other structure on which the antenna orientation assembly 10 is positioned. Additionally, in some situations the user may need to tune the peaking position of the antenna. In such a situation, the user can slightly loosen either of the locking mechanisms to slightly alter the elevation of the antenna, as needed, to achieve a higher peaking signal strength. Similarly, the user can slightly rotate the base of the antenna orientation assembly to alter slightly the azimuth of the antenna. The antenna orientation assemblies described herein result in a mobile mounting apparatus that enables a user to set an antenna at a peaking elevation and azimuth for the antenna to receive signals from a satellite. The antenna orientation assemblies provide low cost solutions for easy installation of an antenna by a user.

The various embodiments described above can be combined to provide further embodiments. These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

The invention claimed is:

1. An antenna orientation system, comprising:
  - a plumb weight;
  - an antenna orientation assembly having a first member configured to connect to the plumb weight and having a second member configured to mount an antenna, the first member and the second member being rotatable about a central axis to adjust an elevation of the antenna relative to the plumb weight; and
  - a base assembly having a footing and at least one support leg connected to the footing and configured to hold the antenna orientation assembly with the plumb weight in a vertical position.
2. The antenna orientation system of claim 1, further comprising:

11

wherein the first member of the antenna orientation assembly having:

- a first surface;
- a second surface opposite the first surface;
- a central axial bore from the first surface to the second surface about which the first member can rotate; and
- a protrusion extending from the second surface; and

wherein the second member of the antenna orientation assembly having:

- a body with a cavity and a central axial bore, the cavity configured to accept the first member and align the central axial bore of the second member with the central axial bore of the first member; and
- an aperture extending into the body configured to accept the protrusion and limit angular rotation of the first member relative to the second member.

3. The antenna orientation system of claim 1, further comprising:

wherein the first member of the antenna orientation assembly having:

- an inner disk;
- an elevation adjustment member adjacent to the inner disk, the elevation adjustment member being is disk-shaped with an aperture extending towards a rotational center of the elevation adjustment member; and

a central axial bore through the inner disk and elevation adjustment member at the rotational center; and

wherein the second member of the antenna orientation assembly having:

- a body with a cavity and a central axial bore, the cavity configured to accept the inner disk of the first member and align the central axial bore of the second member with the central axial bore of the first member; and

a protrusion extending from the body configured to fit inside the aperture of the elevation adjustment member of the first member and limit angular rotation of the second member relative to the first member.

4. An antenna orientation assembly, comprising:

a first member having:

- a first surface;
- a second surface opposite the first surface;
- an axial bore from the first surface to the second surface about which the first member can rotate; and
- a protrusion extending from the second surface; and

a second member having:

- a body with a cavity and an axial bore, the cavity configured to accept the first member and align the axial bore of the second member with the axial bore of the first member; and

an aperture extending into the body configured to accept the protrusion and limit angular rotation of the first member relative to the second member.

5. The antenna orientation assembly of claim 4, further comprising:

at least one support member connected to the second member and configured to mount an antenna.

6. The antenna orientation assembly of claim 4, further comprising:

- at least one base support member; and
- at least one base connector having an axial bore, the at least one base connector connected to the at least one base support member and configured to align the axial bore of the at least one base connector to the axial bores of the first and second members.

12

7. The antenna orientation assembly of claim 6, wherein the at least one base connector includes a locking mechanism to secure an orientation of the first and second members relative to the at least one base support member.

8. The antenna orientation assembly of claim 4, further comprising:

- a plumb having a weight and a mast that is connected between the weight and the first member, the plumb being configured to orient the mast in a vertical position.

9. The antenna orientation assembly of claim 8, wherein the plumb is sized and shaped to maintain an antenna connected to the antenna orientation assembly at an elevation when the first and second members are locked together.

10. The antenna orientation assembly of claim 4, further comprising:

- a locking mechanism to secure an orientation between the first member and the second member.

11. The antenna orientation assembly of claim 4, further comprising:

- at least one antenna support member configured to connect to the second member and to an antenna; and
- a base assembly having a footing and at least one support leg having a first end connected to the footing and a second end configured to hold the first and second members with the antenna at a set elevation.

12. The antenna orientation assembly of claim 11, wherein the footing of the base assembly further includes a compass positioned to indicate an azimuth of the antenna.

13. An antenna orientation assembly, comprising:

a first member having:

- an inner disk;
- an elevation adjustment member adjacent to the inner disk, the elevation adjustment member being is disk-shaped with an aperture extending towards a rotational center of the elevation adjustment member; and

an axial bore through the inner disk and elevation adjustment member at the rotational center; and

a second member having:

- a body with a cavity and an axial bore, the cavity configured to accept the inner disk of the first member and align the axial bore of the second member with the axial bore of the first member; and

a protrusion extending from the body configured to fit inside the aperture of the elevation adjustment member of the first member and limit angular rotation of the second member relative to the first member.

14. The antenna orientation assembly of claim 13, further comprising:

- at least one support member connected to the first member and configured to mount an antenna.

15. The antenna orientation assembly of claim 13, further comprising:

- at least one base support member; and
- at least one base connector having an axial bore, the at least one base connector connected to the at least one base support member and configured to align the axial bore of the at least one base connector to the axial bores of the first and second members.

16. The antenna orientation assembly of claim 15, wherein the at least one base connector includes a locking mechanism to secure an orientation of the first and second members relative to the at least one base support member.

17. The antenna orientation assembly of claim 13, further comprising:

a plumb having a weight and a mast that is connected between the weight and the second member, the plumb being configured to orient the mast in a vertical position.

18. The antenna orientation assembly of claim 17, 5 wherein the plumb is sized and shaped to maintain an antenna connected to the antenna orientation assembly at an elevation when the first and second members are locked together.

19. The antenna orientation assembly of claim 13, further 10 comprising:

a locking mechanism to secure an orientation between the first member and the second member.

20. The antenna orientation assembly of claim 13, further 15 comprising:

at least one antenna support member configured to connect to the elevation adjustment member of the first member and to an antenna; and

a base assembly having a footing and at least one support leg having a first end connected to the footing and a 20 second end configured to hold the first and second members with the antenna at a set elevation.

\* \* \* \* \*